CLAIMS

1. A fluorescent lamp comprising:

a bulb formed by: heating a bent-portion-formation preordination portion of a single straight-tube-shaped bulb member having an external tube diameter of 12 to 20 mm and a tube length of 800 to 2500 mm so as to provide a plurality of bent portions and straight tube portions adjacent to the bent portions by bending working, such that the straight portions are disposed generally within the same plane through the bent portions; forming in close proximity a pair of end portions with electrodes being sealed therein so as to form a single discharge path through the straight tube portions and bent portions; forming a phosphor layer on the inner surface of the bulb; and sealing a discharge medium including mercury; and

a base provided on the end portions of the bulb.

2. A fluorescent lamp according to claim 1, wherein the bent-portion-formation preordination portion is bent so that a radius of curvature at the inner surface of the bent portion is in a range of 1 to 3 times an inner diameter of the tube, and an amount (mg/cm^2) of a phosphor layer adhering to the bent portions is 1/2 or more of that at the straight tube portion.

3. A fluorescent lamp according to claim 1, wherein an application amount of phosphor particles making up the phosphor

layer at the straight tube portions is 4.0 to 7.5 mg/cm^2.

4. A fluorescent lamp according to claim 1, wherein a protective layer of 0.5 μm or more in thickness is formed on the inner surface of the bulb, and the phosphor layer is formed on the protective layer.

5. A fluorescent lamp according to claim 1, wherein the length of the bent-portion-formation preordination portions is within a range of 5 to 50% of an entire length of the straight-tube-shaped bulb.

6. A fluorescent lamp according to claim 1, wherein the bulb is formed in substantially a quadrate shape from five straight tube portions with bent portions formed at each of diagonal line positions of the quadrate shape, with the bases provided on both end portions of the bulb at substantially a central portion of one side of the quadrate shape.

7. A fluorescent lamp according to claim 1, wherein the base is provided with a turn restricting element for restricting a turning angle of the base with respect to the end portions of the bulb to an angle less than a predetermined angle.

8. A fluorescent lamp according to claim 1, wherein the turn restricting element is formed by constructing the base and the end portions of the bulb to which the base is fitted so as to provide elliptical shapes in the axial cross-sectional shape.

9. A fluorescent lamp according to claim 1, wherein the turn restricting element is a engaging element formed on at least one of both joint portions of the base and the end portions of the bulb to which the base is fitted and adapted to restrict the turning of the base exceeding a predetermined angle by engaging the base.

10. A fluorescent lamp comprising:

a bulb formed by: connecting a plurality of straight tube portions having an external tube diameter of 12 to 20 mm within a same plane through bent portions; forming in close proximity a pair of end portions with electrodes being sealed therein so as to form a single discharge path through the straight tube portions and bent portions; forming a phosphor layer on an inner surface of the bulb; and sealing a discharge medium including mercury; and

a base provided on the end portions of the bulb,

wherein a coldest portion to be maximally cooled is formed to at least one of the bent portions at a time of lighting.

11. A fluorescent lamp according to claim 10, wherein a maximum length of an inner tube diameter at the bent portion is 1.2 times or more an inner tube diameter of the straight tube portion.

12. A fluorescent lamp according to claim 10, wherein at the bent portions, one tip end of adjacent straight tube portions extends in an axial direction of the straight tube portion so as to project

beyond a connecting portion.

13. A fluorescent lamp comprising:

a discharge vessel having a glass bulb formed by partially bending a glass tube having an external tube diameter of 12 to 20 mm and a tube length of 800 to 3000 mm so as to form a plurality of straight tube portions and bent portions, which are alternately adjacently arranged, within a same plane, such that both end portion provide straight tube portions so as to be adjacent one another so as to provide entirely a polygonal shape, the glass bulb being provided with a pair of sealed fine tubes for discharge extending from both end portions of the glass bulb, a phosphor layer formed on the inner surface side of the glass bulb, a pair of electrodes sealed on an inner side of both end portions of the glass bulb, and a discharge medium sealed within the glass bulb; and

a base provided to both the end portions of the bulb.

14. A fluorescent lamp according to claim 13, wherein a part of at least one of the paired fine tubes is bent so that the paired fine tubes extend generally parallel to each other.

15. A fluorescent lamp according to claim 13, wherein a center axes of horizontal portions of the paired fine tubes extending in horizontal directions on the sides of the mutually opposing bulb end portion are arranged so as to be offset one another.

16. A lighting apparatus comprising:

a lighting apparatus main unit;

a fluorescent lamp according to claim 1, 10, or 13, disposed in the lighting apparatus main unit; and

a high-frequency lighting circuit which lights the fluorescent lamp by applying high-frequency voltage of frequency of 10 kHz or higher thereto.

17. A method of manufacturing a fluorescent lamp comprising the steps of:

forming a discharge vessel having a straight-tube-shaped glass bulb, in which a phosphor layer is disposed on an inner surface of a glass tube having an external tube diameter of 12 to 20 mm and a tube length of 800 to 3000 mm, and electrode mounts for supporting electrodes and having a pair of fine tubes are sealed at the end portions of the glass tube;

shaping the discharge vessel, in which the straight-tube-shaped glass bulb is partially heated to be softened and then bent so as to alternately form a plurality of tube portions so as to be adjacent to each other and bent portions within a same plane such that both the end portions constitute straight tube portions and are adjacent one another so as to provide an entirely polygonal shape;

exhausting the interior of the discharge vessel from each of the paired fine tubes extending from the end portions of the glass bulb following the discharge vessel shaping step and, subsequently, sealing in a discharge medium and then sealing off the fine tubes;

and

disposing a base on both end portions of the discharge vessel.

18. A manufacturing method according to claim 17, wherein the pair of fine tubes extend in the horizontal direction on the sides of the mutually opposing bulb end portions and has a bent portion curving with a curvature radius of 15 to 30 mm.